



IPL EXPERIENCE WITH ADVANCED METERING

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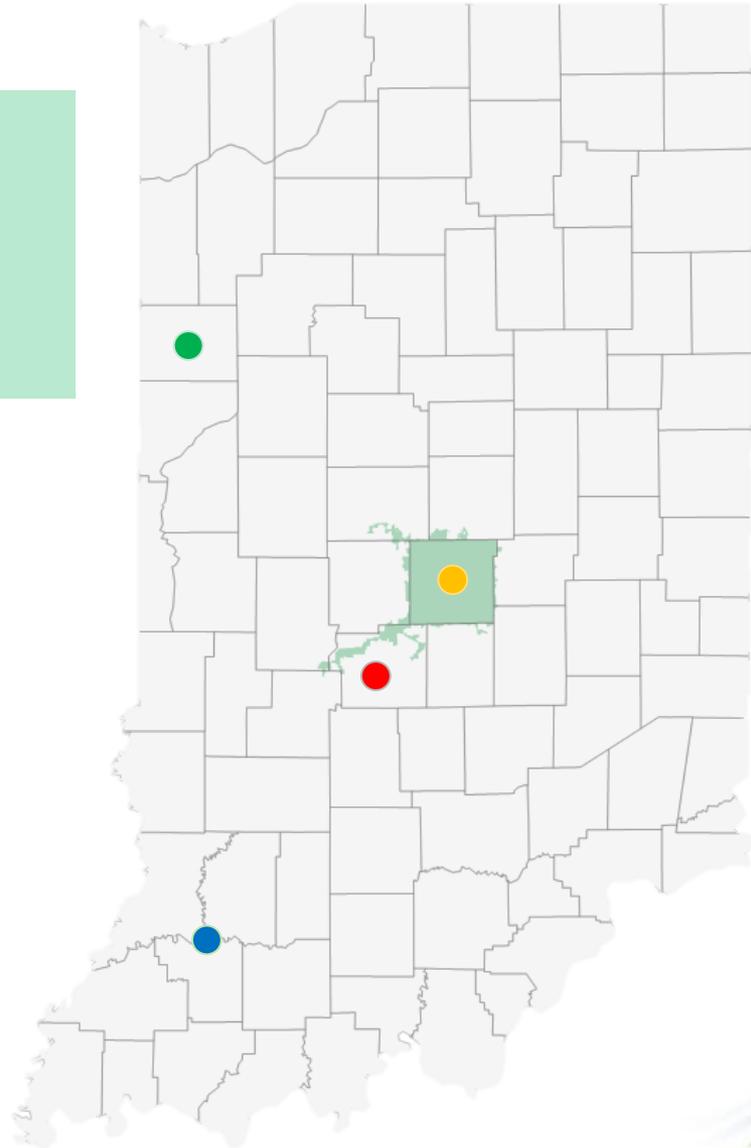


IPL OVERVIEW

QUICK FACTS

- ~490,000 customers
- 528 sq. miles territory
- 144 substations
- ~2,900 MW Peak, ~14 million MWh annually

- **Indianapolis area assets ~1,200 MW**
 - Harding Street Station (HS) - 977 MW
 - Georgetown Station - 150 MW
 - Solar PPAs - 96 MW
- **Eagle Valley (EV) Generating Station - 671 MW**
- **Petersburg Generating Station - 1,700 MW**
- **Hoosier Wind Park PPA - 100 MW**
- **Lakefield Wind Park PPA - 200 MW**
(In Minnesota - Not pictured)





IPL SMART ENERGY INITIATIVES



SMART SOLUTIONS

ELECTRIC VEHICLE CHARGING:

- **Benefit:** Increases viable infrastructure to support electric vehicle adoption in Indianapolis and the surrounding counties
- **Description:** Blue Indy's car sharing service and IPL's public charging infrastructure accounts for over 450 electric vehicle charging stations in Indianapolis

DISTRIBUTED ENERGY RESOURCES:

- **Benefit:** Provides localized energy resources that serve local load and offset demand during system peak hours
- **Description:** -100MW of solar photovoltaic (PV) as a generation resource

BATTERY ENERGY STORAGE:

- **Benefit:** Enables efficient dispatch of existing generating assets and integration of renewable energy resources
- **Description:** 20MW (utility scale, grid integrated) battery energy storage at IPL's Harding Street Station

LED STREET LIGHTING:

- **Benefit:** Reduces energy and maintenance costs, and increases public safety in Indianapolis
- **Description:** Complete conversion of 27,000 existing High Pressure Sodium street lights to high efficiency LEDs over the next three (3) years

DEMAND RESPONSE:

- **Benefit:** Enables instantaneous reduction of load during critical peak hours
- **Description:** Two-way communicating load control switches, and Nest smart thermostats allow for two way communication between the utility and customers

ADVANCED METERING INFRASTRUCTURE (AMI)

- **Benefit:** Visibility to real time customer power quality and outages, and proactive identification of system issues
- **Description:** 75,000 AMI meters with remote connect and disconnect

LINE RECLOSERS

- **Benefit:** Improved customer reliability (SAIFI and SAIDI)
- **Description:** Approximately 300 line reclosers are on the distribution system with remote control to minimize large outage impacts

DISTRIBUTION CAPACITOR BANKS

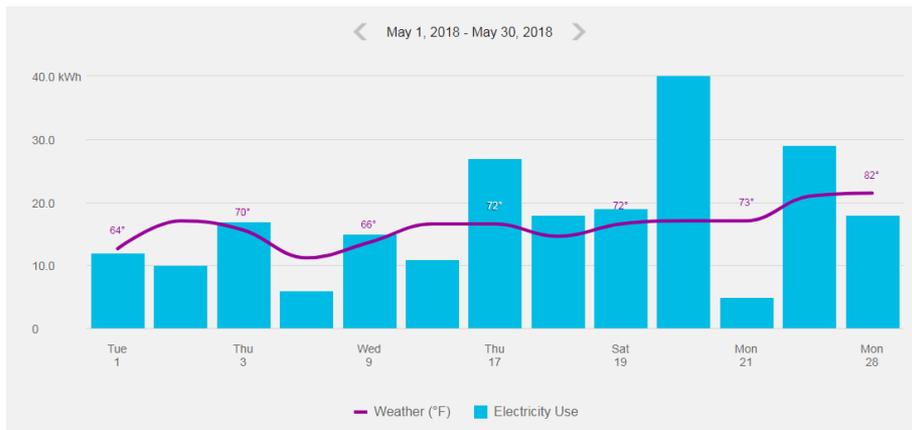
- **Benefit:** Improved customer power quality with smart controls that are monitored and controlled from a central system
- **Description:** Approximately 1,300 distribution capacitor banks are coordinated with substation equipment for power quality



ADVANCED METERING

- IPL now has more than 150,000 two-way AMI meters installed
- Minimum daily read from all customers with AMI and AMR meters

PowerVIEW®



IPL AMI Meters Installed





DATA ARCHITECTURE AND FLOW

Landis+Gyr
(L+G)
Customer
Meters

L+G
Command
Center

Meter Data
Management
System
(MDMS)

Customer
Accounting
System (CAS)



FRAMING USE CASES FOR ANALYTICS

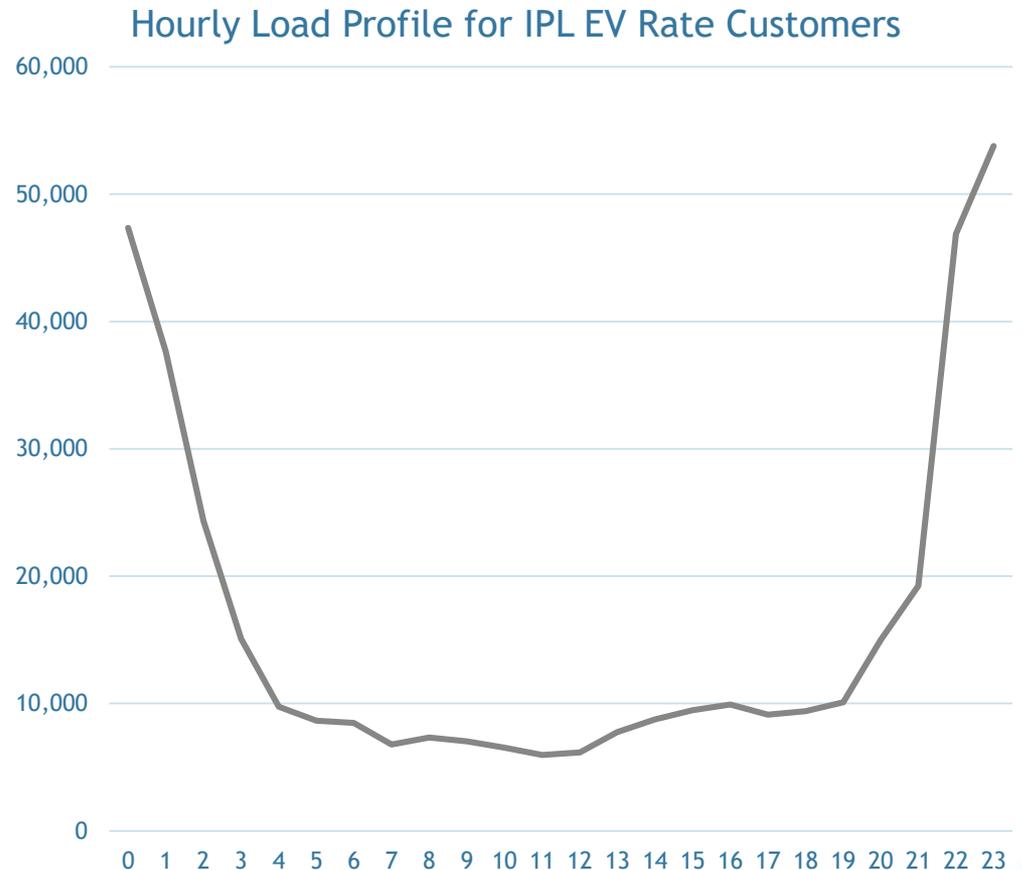
DESCRIPTIVE	Standard reports, ad hoc reports, query/drill down, alerts	“What happened?” “How many, how often, where?” “What exactly is the problem?” “What actions are needed?”
PREDICTIVE	Statistical analysis, forecasting, predictive modeling	“Why is this happening?” “What if these trends continue?” “What will happen next?”
PRESCRIPTIVE	Experimental design, optimization	“What happens if we try this?” “What’s the best that can happen?”
AUTONOMOUS	Machine learning	“What can we learn from the data?”

Source: *Competing on Analytics* by Thomas H. Davenport and Jeanne G. Harris



CASE #1: ELECTRIC VEHICLE FORECASTS

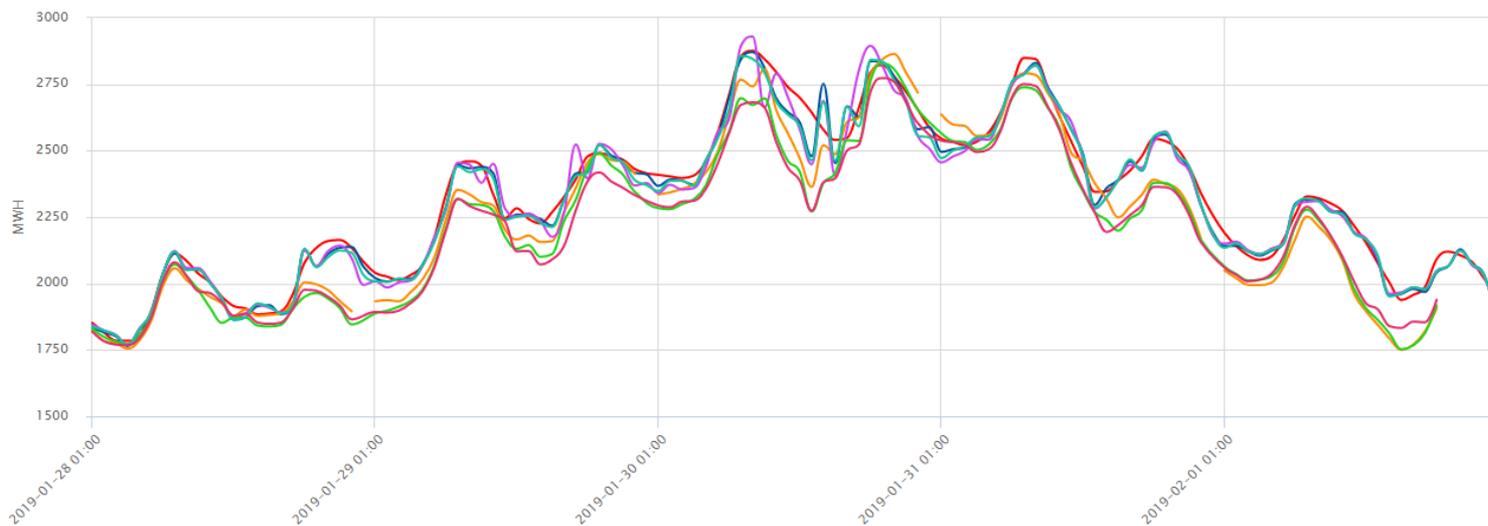
- Blue Indy partnership
- Public EV charging stations
- International Airport adding 9 electric buses to shuttle fleet
- IPL EV Rates (EVX)





CASE #2: LOAD FORECASTING

- IPL currently using machine learning-based short term (<14 days) load forecast with system-level load data
- Exploring using AMI data to inform weather sensitivity and trends by load class





LOOKING FORWARD

Potential for enhanced customer experience and value as IPL builds out analytics infrastructure and capabilities

CUSTOMER

- Usage/Billing
- Enabling Time of Use or other dynamic rates
- Enhanced customer experience with visibility into detailed usage patterns
- Insight into usage patterns to improve load forecasting accuracy

PLANNING

- DSM Market Potential
- DSM Program Design and Implementation
- Electric Vehicle Penetration and Load Shapes
- Distributed Generation Forecasts, Location, and Load Shapes
- Load Profiling/Load Research

OPERATIONS

- Circuit reliability
- Voltage conservation
- Outage detection and management
- Circuit-specific loading profiles for distribution network

QUESTIONS/PANEL